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UNITED STATES DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Division of Fishery Services
Fort Collins, Colorado

Special Report

PESTICIDE SURVEILLANCE PROGRAM

Teton Bark Beetle Control Project
Teton National Forest
Teton County, Wyoming
U.S. Forest Service
November 8-10, 1965

March 4, 1966

Special Report

Pesticide Surveillance Program

Teton Bark Beetle Control Project
Teton National Forest, Wyoming

Introduction

Severe infestations of the Mountain Pine Beetle occur in large areas of the Teton National Forest and Grand Teton National Park near Jackson, Wyoming. Control measures have been underway for several years by both the Forest Service and the National Park Service to prevent the spread of the infestation. It is particularly desirable to keep this infestation from reaching the adjoining Yellowstone National Park.

The infestations are found primarily in fairly dense stands of lodgepole pine. The beetle attacks mostly mature trees and will eventually kill the tree. Large numbers of dead trees can presently be observed in some areas of both the National Forest and National Park.

Control measures consist of harvesting mature timber where feasible and also using chemicals for control of the beetle. The current chemical method is to use a mixture of ethylene dibromide and fuel oil to hand spray individual infested trees. The number of infested trees may range from 4 or 5 per acre upward to over 50 per acre where heavy infestations occur. Thus, fairly heavy applications of the spray mixture may be made in some areas.

The Grand Teton area is extremely important from the standpoint of fish and wildlife and contains some of the countries largest big game herds. Information is desired as to whether chemical control operations have a significant effect on fish and wildlife. During control operations in the Teton National Forest in November, 1965, limited observations were made to determine possible effects on aquatic life in several streams in the spray areas.

Summary and Conclusions

Bark beetle control operations were carried out by the Forest Service in 1965. Major areas in the Teton National Forest receiving chemical treatment are shown in Figure 1. Approximately 300,000 trees were treated over an area of about 80,000 acres covered with fairly dense stands of lodgepole pine (Figure 2). Spray operations were conducted during the month of June and were continued in November-December, 1965. Some areas that had been treated in June were re-treated during the later period.

The spray material, 1½ pounds of ethylene dibromide in 5 gallons of fuel oil, was mixed in a central mixing plant (Figure 3) and placed in 5 gallon cans. The filled cans were transported by truck to a base camp near the spray area. Pack horses were used to transport the cans to the actual spray site (Figure 4). Individual infested trees, which had been marked previously, were then sprayed by hand with a stirrup pump to a height of 30 feet (Figure 5). About 3 gallons of the spray mixture was applied to each tree. In some heavily infested areas, over 50 trees per acre were treated. In some of these areas the ground and understory of vegetation was covered almost completely with spray material.

It is believed that this operation would be unlikely to have any detrimental effect on aquatic life in streams in the area. The central mixing plant is located in an old gravel pit and there is little possibility of any spillage from this plant reaching surface waters. While there is some spillage of the spray mixture from the individual tree spraying, most of the treated areas are well away from streams, and it is believed that very little of the material washes into the streams.

Limited observations in November indicated little, if any, effect on bottom macroinvertebrates. A variety of aquatic animals, including mayfly, stonefly, and caddisfly larvae were present in several areas examined in Blackrock Creek and Spread Creek. However, these observations were inadequate to obtain sufficient information to properly evaluate possible effects on bottom fauna. In June, stream waters were too high to obtain adequate samples. In November, anchor ice prevented obtaining quantitative samples.

End

No observations were made with respect to possible effects on wildlife. Applicators and Forest Service personnel stated that they had observed no mortality or other effects on wildlife during any of their previous spray applications. However, they had observed some fairly severe effects on ground vegetation in some of the treated areas.

Recommendations

Ethylene dibromide is relatively non-toxic to fish, however, little information is available as to possible effects on fish food organisms. It is impossible to obtain adequate observations on bottom macroinvertebrates during actual spray periods in June and November. It would be desirable to conduct additional bottom animal studies during late summer or early fall when conditions are more favorable.

Little information is available as to the effects of this type of operation on native wildlife in treated areas. In heavily treated areas, considerable EDB and fuel oil covers the ground and understory of vegetation. Some of these plants may be used as wildlife foods. Observations on wildlife should be made during both the June and November-December treatment periods. The June period would probably be best for observations on birds (nesting, etc.) and small mammals. Larger mammals, principally elk utilize the areas during the fall and winter migration periods.

Teton Bark Beetle Control Project
Teton National Forest, Wyoming

Description of Area

The Teton National Forest is in the northwestern corner of Wyoming, almost surrounding the area known as Jackson Hole. Grand Teton National Park borders the National Forest on the West and Yellowstone National Park on the North. The Continental Divide forms much of the boundary on the East. Three major US Highways, US 287, 89 and 26 traverse the area. The famous tourist town of Jackson, Wyoming, is the population center and lies near the western Forest boundary. Forest Service Headquarters are located in Jackson.

The National Forest comprises over 1,700,000 acres of mountainous terrain lying at elevations ranging from 6,000 to over 12,000 feet. About 1/2 million acres in the northern portion are in the Teton Wilderness Area.

The Teton National Forest, along with the two neighboring National Parks, comprise one of the most famed and visited recreational areas in the United States. Wildlife and scenery are among major attractions. Large numbers of big game animals consisting of elk, deer, bear and moose roam the area and are favored tourist attractions as well as being sought after by hunters. Large herds of elk move from the high country into the Jackson Hole area in the winter and many thousands over winter in the National Elk Refuge which borders the Teton National Forest. Thousands of hunters from all over the United States come to the Jackson Hole area every fall and winter for their big game trophies. Guiding and outfitting in the area are big business. The area also contains many fine streams and lakes which furnish excellent trout fishing. Lumbering and livestock grazing are other important functions carried out in the National Forest.

The major areas treated for mountain bark beetle control during 1965 are shown in Figure 1. Most of the areas are just south of the Teton Wilderness Area and west of the Grand Teton National Park. Control operations are also carried out by the National Park Service within the National Park. Most of the areas treated are fairly solid and dense stands of lodgepole pine, the major commercial timber species (Figure 2). Large numbers of dead and dying trees can be observed in heavily infested areas and detract considerably from the scenery. Efforts to control the bark beetle and prevent its further sprea into Wilderness and Park areas have been carried out for the past several years

The Pesticide Operation

Bark beetle control operations were carried out in the Teton National Forest during the month of June, 1965, and again in November-December, 1965. The beetle is in the larval stage and under the bark during these periods and is more susceptible to the fumigant type toxicant. In summer months when the adult emerges, treatment with chemical is not as effective.

The spray material, 1½ pounds of ethylene dibromide (6 lbs. per gallon EDB concentrate) in 5 gallons of fuel oil is mixed in a central mixing plant located just north of Highway 287 near the Blackrock Ranger Station. The location, in an old gravel pit (Figure 3), prevents the likelihood of any spillage reaching surface waters. Material is mixed at this site for all operations in the Teton National Forest and also for bark beetle control operations being carried out in the Grand Teton National Park.

At the mixing plant the spray mixture is placed in 5 gallon cans. Trucks are used to haul the full cans to a base camp near the spray area (Figure 4). Pack horses, with rubber or plastic blankets to protect them for any spillage of the spray material, are used to transport the cans to the actual spray site. Individual infested trees, which have been previously marked are sprayed by hand with a stirrup pump to a height of about 30 feet (Figure 5). Pressure is furnished by a gasoline powered portable compressor. If trees are infested to a greater height, they are chopped down and sprayed on the ground. Much of the spray material does not strike the tree and winds up on the ground. In heavily infested areas, where a large number of trees are sprayed, the understory of vegetation is pretty well covered with spray material. A strong odor of fuel oil is apparent throughout the area where spray operations are being conducted.

While exact figures are not available, the 1965 operations were expected to treat approximately 300,000 trees in about 80,000 acres of forest. Infested trees which were sprayed ranged from 4 or 5 per acre in some areas to over 50 per acre in heavily infested areas.

The main mixing plant is operated by the Forest Service. Transport of the spray mixture, operation of base camps and actual spraying are contracted to private contractors. The Forest Service marks the trees to be sprayed and has observers in the area during spray operations.

Toxicity Information

Ethylene dibromide is a fumigant type toxicant and is quite volatile. Fumes from the material penetrate the bark and kill the beetle larvae which are mostly in the cambium layer underneath.

EDB is relatively non-toxic to fish. Laboratory experiments with rainbow trout have shown a TLm (LD_{50}) value of 7.0 ppm (studies of the Effect of Forest Insect Control with Ethylene Dibromide on Water Quality, PR-9, Colorado River Project, U.S. Public Health Service, Region VIII, Denver, Colorado, June 1963). No information was available as to effects on other aquatic animals. The chemical is reported as rather toxic to warm blooded animals with an oral LD_{50} value to white rats of 117 mg./kg. (Johnson et al, Pesticides, Chemical Week, May 25, 1963).

Observations and Results

Limited observations of the Bark Beetle control operation in the Teton National Forest was made on November 9 and 10, 1965. The fall spray operation had just started several days previously.

Operation of the central mixing plant was observed. This plant is well located in an old gravel pit some distance away from any stream. There is little likelihood that spillage from the plant could enter any surface waters.

Individual tree treatment was observed on several areas in the Blackrock Creek drainage. A base camp was located on a ridgetop near a road and well away from any stream. Very little spraying is actually done near the streams. Most of the observed bark beetle infestations were on the ridgetops or side hills. One of the spray areas observed was quite heavily infested, with practically every mature tree marked for treatment. In spraying this area, the ground and understory of vegetation was almost completely covered with the EDB-fuel oil mixture. The fuel oil will no doubt have some effect on this vegetation. What effect this may have on resident wildlife is unknown. No wildlife was observed in the spray area during this visit.

Observations were made on a number of areas which had been treated in June, both in the National Forest and National Park. Large numbers of dead trees were observed in some of these areas, especially in the Pacific Creek drainage.

An attempt was made to collect quantitative bottom samples in several sections of Blackrock Creek and Spread Creek (Figure 8). Anchor ice prevented obtaining adequate samples. However, a fair population of bottom animals, including mayfly, stonefly and caddisfly larvae was observed in all areas examined. The streams in the lower valley and flats appeared much less productive than upstream areas. Apparently the lower reaches contain a much larger percentage of shifting gravel bottom (Figure 8) while upstream reaches are more stable (Figure 7). Shifting gravel during high water periods can greatly reduce bottom fauna. It is believed that the EDB operations have not had any significant effect on bottom fauna. However, as there is little information available as to the effect of EDB on bottom fauna, additional observations should be made during more favorable stream conditions, possibly in the late summer or fall. No oil slicks or other evidence of the spray material reaching any of the streams was noted.

Water quality conditions in Blackrock Creek near the upper and lower reaches of the spray area were as follows:

Location	Water Temp. °F	D.O. ppm	pH	Alk. ppm	Hardness ppm	Conductivity µmhos
Upper	32	9.4	7.5	34	86	200
Lower	32	10.0	7.8	48	120	250

Discussion

Ethylene dibromide has a relatively low toxicity to trout and would not be expected to have a direct effect on fish unless from a major spill. Adequate precautions have been taken by the Forest Service to prevent any spillage into surface waters. Little information is available as to the toxicity of EDB to fish food organisms. Blackrock Creek may be a good area in which to make additional observations on bottom fauna. However, during the June spray period, all of the streams are quite high and it would be difficult to obtain adequate samples. During the November-December period, ice conditions prevent proper sampling. Probably, the best period for observations or studies woudd be after the streams return to normal flows in the late summer or early fall. Even if the spray operations are not being conducted during these periods, any major or lasting effects could be determined by adequate sampling during this period.

Some of the heavily infested ridgetops and side hills receive a heavy application of the spray mixture, much of which ends up on the ground or understory of vegetation. EDB is fairly toxic to warm blooded animals and the large amounts of oil may have an effect on vegetation. It is believed that the possibility of this type operation having an effect on wildlife is more likely than an effect on fish. At least some observations should be made on wildlife in the area, preferably during periods of actual spray application.

Contributions of Other Agencies

The following personnel participated in or contributed to this investigation:

U.S. Forest Service, Jackson, Wyoming

Mr. R. L. Safran, Supervisor, Teton National Forest
Mr. Roy Morgan, Pest Control Specialist, Teton National Forest
Mr. Bill Thompson, Assistant Pest Control Specialist, Teton National Forest
Mr. Bob Casebeer - Wildlife Manager, Teton National Forest
Mr. Ivan Thornton, Assistant Wildlife Manager, Teton National Forest

Wyoming Fish and Game Department, Jackson, Wyoming

Mr. Max Rollefson, Biologist
Mr. John Erickson, Biologist

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Mr. Croswell Henderson, Fishery Biologist, Fort Collins, Colorado
Mr. Bill Melander, Fishery Management Biologist, Lander, Wyoming

Croswell Henderson, Fishery Biologist
Date: March 4, 1966

Reviewed:

Regional Supervisor, Division of Fishery Services
Date: 3/11/66

Assistant Regional Director, Cooperative Services
Date: 3-14-66

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Forest Service, Ogden - 2
Wyoming Fish and Game Department - 2
Fishery Services, Field Offices - 11
Mark Morton, Portland - 1
Denver Wildlife Research Center - 2
Fish-Pesticide Research Laboratory - 2
Extension Pesticide Specialist, Fort Collins - 1
Colorado Cooperative Fishery Unit - 1
Colorado Cooperative Wildlife Research Unit - 1

Figure 2. Large areas in the Teton National Forest, mostly dense stands of lodgepole pine, are infested with bark beetles

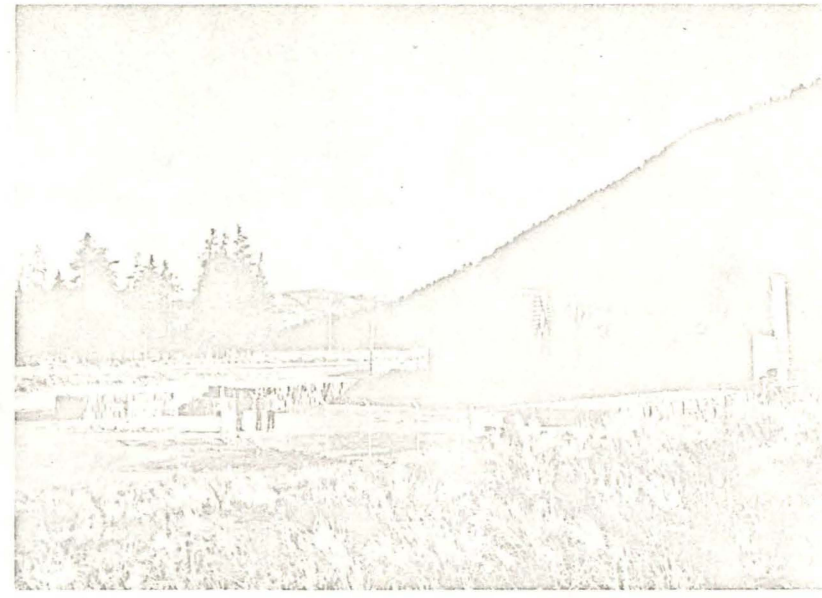

Figure 3. The spray mixture, Ethylene Dibromide and Fuel Oil, is prepared in a central mixing pla and placed in 5-gallon cans

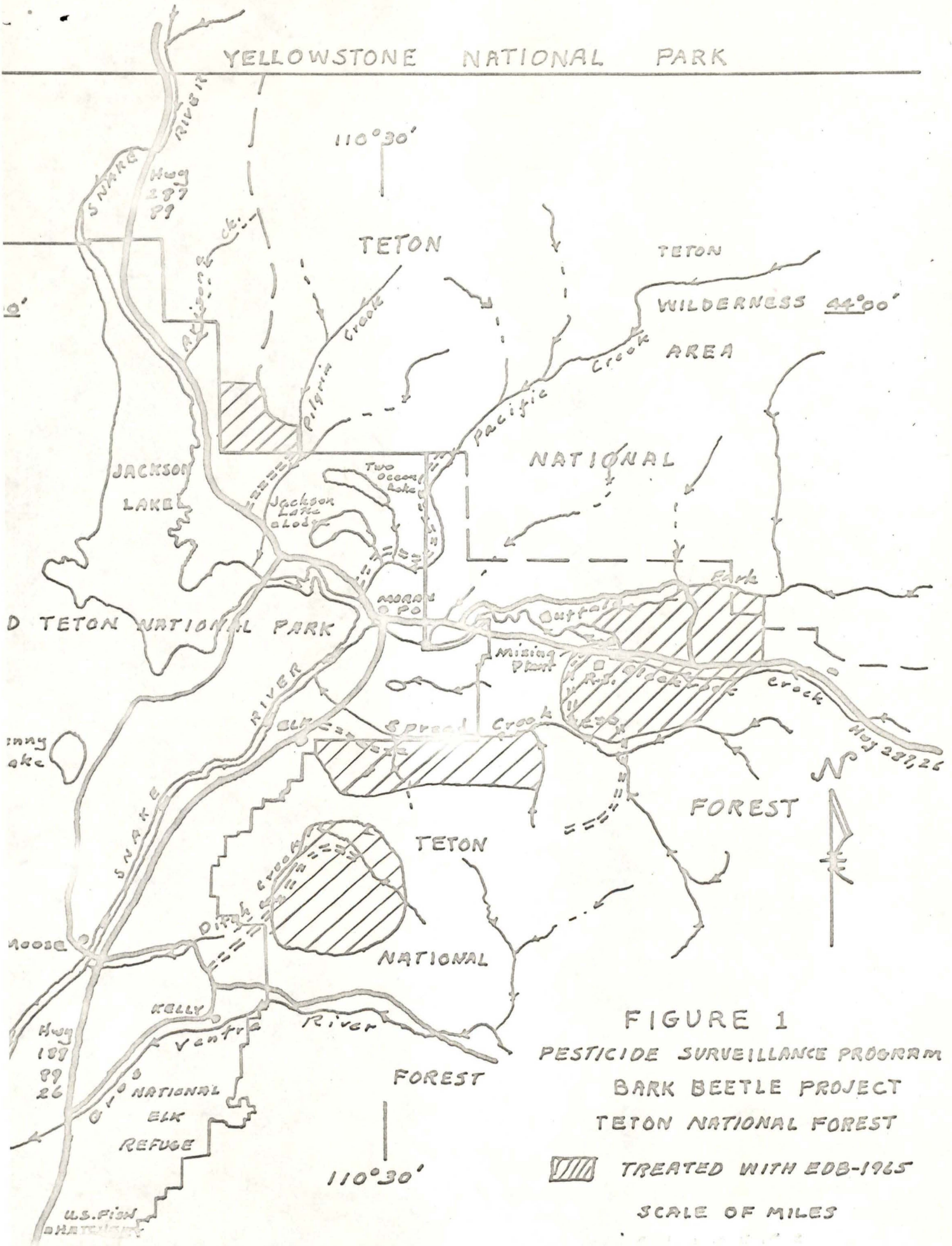

FIGURE 1

PESTICIDE SURVEILLANCE PROGRAM

BARK BEETLE PROJECT

TETON NATIONAL FOREST

▨ TREATED WITH EDB-1965

SCALE OF MILES

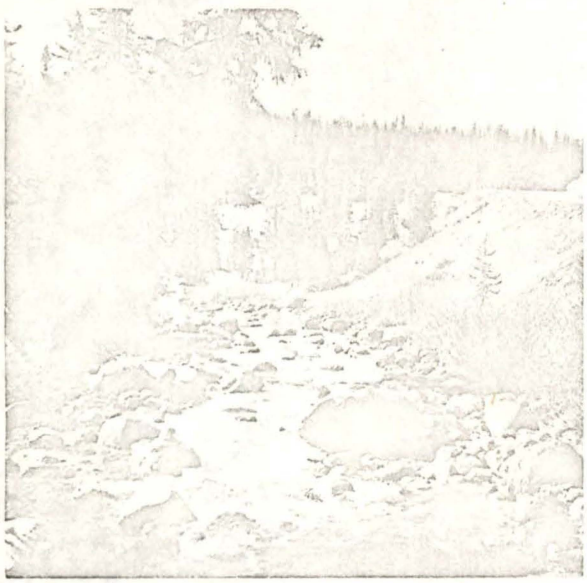

Figure 6. Spray areas contain a number of fair trout streams. This one is Blackrock Creek

Figure 7. In upstream areas, the bottom is relatively stable and fish food organisms are abundant

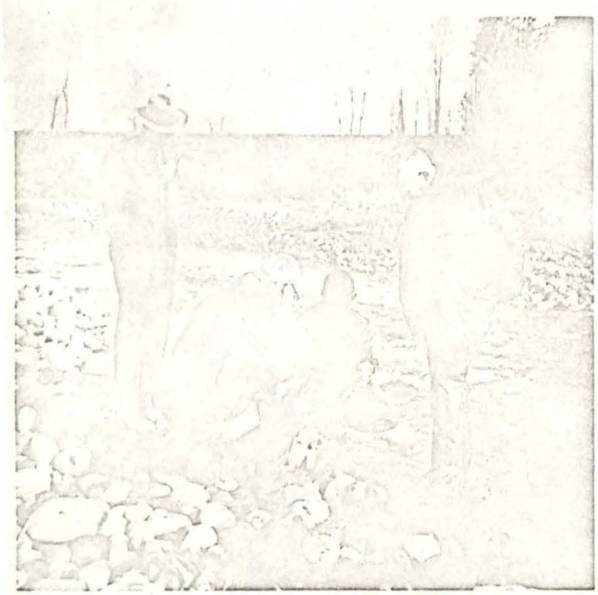

Figure 8. Further downstream the shifting gravel bottom causes a reduction in bottom fauna